

IN THE SPECIFICATION

Please amend the paragraph starting on page 1, line 6 as follows:

This application is a ~~continuation-in-part~~ continuation of U.S. patent application serial No. ~~09/892,921~~ 10/158,250, filed ~~June, 26, 2001~~ May 30, 2002, titled "~~Packaging and Assembly Method for Optical Coupling~~, A FLIP-CHIP PACKAGE INTEGRATING OPTICAL AND ELECTRICAL DEVICES AND COUPLING TO A WAVEGUIDE ON A BOARD" Attorney Docket No. ~~042390.P10500~~, now U.S. Patent No. _____, which is a continuation-in-part of U.S. patent application serial No. 09/892,921, filed June, 26, 2001, titled "~~Packaging and Assembly Method for Optical Coupling~~", now U.S. Patent No. 6,512,861 B2.

Please amend the BRIEF DESCRIPTION OF THE DRAWINGS on page 5, lines 2-5 as follows:

~~FIG. 1~~ FIG. 1A and FIG. 1B illustrate is a cross-sectional view of a package suitable for implementing embodiments of the present invention;

~~FIG. 2~~ FIG. 2A and FIG. 2B illustrate is a cross-sectional view of an alternative package suitable for implementing embodiments of the present invention; and

Please amend the paragraph starting on page 5, line 14 as follows:

The opto-electronic transmitters and receivers 102 in FIG. 1A, for example, are first flip-chip bonded to integrated circuits 104 such as drivers, transimpedance amplifiers, microprocessors, etc. The integrated circuits 104 are then flip-chip bonded to substrates 108, which are incorporated into Ball Grid Array (BGA) 106 or Land Grid Array (LGA) packages. Flip-chip bonding, otherwise known as controlled collapsed chip connection technology or solder bump technology, involves solder bumps on the chip that are reflowed to make connection to terminal pads on the substrate.

Please amend the paragraph starting on page 6, line 4 as follows:

An alternative BGA package 206 suitable for implementing embodiments of the present invention is shown in FIG. 2A. A driver or transimpedance amplifier chip 104 is flip-bonded on a first surface of the BGA package substrate 208, and a bottom emitting or sensing optically active device 102 is flip-bonded on a second surface of the BGA package substrate 208, and the BGA package 206 is bonded to a printed circuit board (PCB) 110 using solder reflow technology. The example system 200 also has a waveguide 170 to direct the light from the device 102 through the PCB 110.

Please amend the paragraph starting on page 9, line 18 as follows:

~~FIG. 1~~ FIG. 1A and FIG. 1B illustrate is a cross-sectional view of an optoelectronic system 100 suitable for implementing embodiments of the present invention. The example system 100 includes packaging that provides pitch transformation from fine pitch to coarse pitch. The system 100 includes a bottom emitting optically active device 102 (or a bottom detecting optically active device 102) that is flip-chip bonded on a driver 104 or transimpedance amplifier chip 104. The driver 104 or transimpedance amplifier chip 104 is flip-chip bonded on a ball grid array (BGA) package substrate 108, and the BGA package 106 is solder reflowed to a printed circuit board (PCB) 110 that includes a waveguide 170.

Please amend the paragraph starting on page 10, line 3 as follows:

The active face (emitting or detecting surface) of optically active devices, such as the device 102, is on the side opposite of the electrical traces (the interconnect surface). Example bottom emitting or detecting optically active devices 102 are shown in ~~FIG. 1 and FIG. 2~~ FIG. 1A, FIG. 1B, FIG. 2A and FIG. 2B.

Please amend the paragraph starting on page 11, line 6 as follows:

According to the embodiment shown in FIG. 1A, the optically active device 102 is flip-chip bonded on the driver or transimpedance amplifier chip 104 using well known solder bump technology. For example, the device 102 has two solder bumps, 120 and 122, which are very tiny and spaced very close together. The device 102 may have more than two solder bumps. If the device 102 were to be mounted directly on the PCB 110, the PCB 110 would have to have very fine features to accommodate the tiny and closely spaced solder bumps 120 and 122. This requirement may cause the PCB 110 to be more complex and the manufacturing process for the PCB 110 would be costly.

Please amend the paragraph starting on page 13, line 1 as follows:

The embodiment shown in FIG. 1A also provides fine alignment of the BGA package 106 with the PCB 110. The solder balls 140 and 142 rest on the pads 141 and 143, respectively, and self-align within the pads 141 and 143 during solder reflow. In this embodiment, the solder balls 140 and 142 set the height of the package 100 in the “z” dimension and have no constraints in the “x” dimension or the “y” dimension. The final tolerance may be determined by the placement accuracy of the flat pads 141 and 143.

Please amend the paragraph starting on page 13, line 20 as follows:

The arrows 190 and 192 in FIG. 1A illustrate the direction light travels from the emitting device 102, to the waveguide structure 170, and to a receiving optically active device 102 (not shown in FIG. 1B). The reverse is true for light arriving at the receiving optically active device shown in FIG. 1B. Although FIG. 1A and FIG. 1B illustrate light traveling from the emitting device 102 in FIG. 1A to the receiving optically active device 102 shown in FIG. 1B, the light may also travel in a bidirectional manner from an

emitting device 102 in FIG. 1B to a receiving optically active device 102 shown in FIG. 1A.

Please amend the paragraph starting on page 14, line 1 as follows:

~~FIG. 2~~ FIG. 2A and FIG. 2B illustrate is a cross-sectional view of an alternative BGA package 206 suitable for implementing embodiments of the present invention. A driver or transimpedance amplifier chip 104 is flip-bonded on a first surface of the BGA package substrate 208, and a bottom emitting or sensing optically active device 102 is flip-bonded on a second surface of the BGA package substrate 208, and the BGA package 206 is bonded to a printed circuit board (PCB) 110 using solder reflow technology. The example system 200 also has a waveguide 170 to direct the light from the device 102 through the PCB 110.

Please add a paragraph starting on page 14, line 8 as follows:

The arrows 190 and 192 illustrate the direction light travels from the emitting device 102, to the waveguide structure 170, and to a receiving optically active device 102 (shown in FIG. 2B). The reverse is true for light arriving at the receiving optically active device 102 shown in FIG. 2B. Although FIG. 2A and FIG. 2B illustrate light traveling from the emitting device 102 in FIG. 2A to the receiving optically active device 102 shown in FIG. 2B, the light may also travel in a bidirectional manner from an emitting device 102 in FIG. 2B to a receiving optically active device 102 shown in FIG. 2A.